STATE OF VERMONT
PUBLIC SERVICE BOARD

Docket No. 7032

Joint Petition of Vermont Electric Power Company, Inc. ("VELCO"), Green Mountain Power Corporation ("GMP") and the Town of Stowe Electric Department ("Stowe") for a Certificate of Public Good pursuant to 30 V.S.A. § 248 authorizing VELCO to upgrade a substation in Moretown, Vermont; construct .3 miles of side by side, single pole tap; construct a switching station in Duxbury, Vermont; construct 9.4 miles of 115 kV transmission line; upgrade an existing GMP 34.5 kV subtransmission line; construct a substation in Stowe, Vermont; and for Stowe to construct 1.05 miles of 34.5 kV sub transmission line in Stowe, Vermont.

THE INITIAL BRIEF
OF
THE VERMONT DEPARTMENT OF PUBLIC SERVICE

INTRODUCTION

The Vermont Department of Public Service proposes that the Public Service Board make the findings and conclusions stated below. In summary, the Lamoille County Project ("LCP") constitutes a necessary addition to Vermont's transmission system, and is required to assure acceptable levels of reliability to the Lamoille County Study Area ("LCSA"). With appropriate mitigation and post-certification review procedures, construction of the LCP will not have undue adverse effects, and satisfies the Section 248 criteria. The DPS supports a conclusion that construction of the LCP, if modified in certain respects as described below, promotes the general good of the state and meets the criteria of §248(b), and supports issuance of an appropriately conditioned Certificate of Public Good ("CPG").

Part I - Section 248 Criteria

1. The local area transmission system at issue in this proceeding, or Lamoille County Study Area ("LCSA"), is a network of 34.5 kV subtransmission lines that are primarily supplied by three VELCO 115 kV to 34.5 kV step-down substations located in Middlesex, East Fairfax and Irasburg. Smith pf. at 3-4.

2. This network is a looped network, i.e., the majority of the distribution substations supplied by the network have the benefit of service from two directions. During load levels when the transmission capacity is adequate, reliable electrical service is maintained to these substations following a contingency. Smith pf. at 4.

§248 (b)(1)

Proposed Findings

3. VELCO has had numerous interactions with various regional and municipal planning commissions in the affected area. Allen pf at 9.
4. Based on these interactions, the Towns of Duxbury, Stowe, Waterbury and the Lamoille County Regional Planning Commission have sent responses to the Vermont Public Service Board, and VELCO has made various improvements to the design of the Project in response. Allen pf at 9.
5. Department witness David Raphael also addresses the issue of compliance with community standards and plans in his report and as part of his application of the Quechee test to the project. Allen pf at 9. Exh. DPS-DR-1 at 115-126.
6. Many of the statements in the plans of the affected municipalities and regional planning commissions are broad goals and visions that do not constitute clear standards within the meaning of the Quechee test. Exh. DPS-DR-1 at 115.
7. There are no existing provisions that state specific community standards with regard to aesthetics and electric transmission corridors and facilities, which would be directly violated by the LCSA. Exh. DPS-DR-1 at 115.
8. On this basis, there appears to be adequate reason for concluding that due consideration has been given to orderly development in the region**.** Allen pf at 9.

Discussion

Pursuant to §248 (b)(1) the Board is required to find that in-state facilities will not unduly interfere with the orderly development in the region with due consideration having been given to the recommendations of the municipal and regional planning commissions. Based on the findings proposed above, the Department recommends that the Board find that Petitioners have met the §248(b)(1) criterion.

§248(b)(2)

General Considerations

9. Both current demands and future growth require that a satisfactory transmission solution be developed. Allen pf at 9.

10. The need for the LCSA project exists and cannot be met satisfactorily through alternative means. Allen pf at 9. Smith pf at 10-16.

11. Demand side management or distributed generation is not available in sufficient quantities to address the needs, therefore a transmission solution would be required in this area. Welch pf at 2; Smith pf at 4.

12. The LCSA area has two distinct needs. First, even with all of the area's subtransmission lines in service, the so-called "all lines in" condition, when the area load reaches 74 MW the present system would be incapable of supplying the loads and maintaining voltages above 95%. A voltage level of 95% is required with "all lines in" in order to provide margin for a contingency due to the fact that voltage normally experiences a sudden drop following a contingency. Smith pf at 4.

13. Second, at 81 MW load levels, the present system can not maintain voltage levels above 90%. A precontingency voltage level of 90% provides essentially no margin for a contingency. At this level, a contingency has a good chance of causing voltage collapse and loss of load. This is especially true for systems that make extensive use of capacitors for reactive compensation, such as the LCSA. This occurs because the reactive support provided by the capacitors diminishes by the square of the voltage. A system in a state of voltage instability is vulnerable to voltage collapse and wide-spread blackouts following any further disturbance or changes in loading. The load level of 81 MW could be reached within the next few years. Smith pf at 4.

14. A looped subtransmission system with adequate capacity should be capable of supplying the connected distribution substations following a line or substation contingency. However, the present system is not capable of providing this level of reliability, even at moderate load levels. Smith pf at 4.

15. At an area load level of approximately 40 MW, the system is not capable of serving the

load and maintaining acceptable voltages, say 90% or greater, following certain contingencies. At a load level of 53 MW, the area would likely suffer a voltage collapse for these contingencies. Smith pf at 5.

16. Upon disconnection of a given line section, the transmission system should have enough capacity to supply the substation loads from the remaining lines. The two primary measures limiting capacity relate to thermal capacity and impedance. With insufficient thermal capacity, related to wire size and ambient conditions, an overloaded line can sag below safe clearances and in extreme cases sag into an object or the ground resulting in a fault. Permanent damage can result. With too much impedance, impedance being related to line length, geometry and nominal operating voltage, low voltages occur. In severe cases, a situation of voltage collapse or blackout of a local area can occur. Smith pf at 5-6.

17. Transmission lines are susceptible to several sources of failure including lightning strikes, trees falling on the line, insulator failures, fires, extreme winds, extreme ice loading and other mechanical failures. Smith pf at 6.

18. The outage rates experienced by Green Mountain Power (GMP) and Central Vermont Public Service (CVPS) in the area under consideration is 0.12 events per mile per year. This rate applies to so-called permanent faults or those faults in which the line can not be restored automatically within a few seconds. Smith pf at 6.

19. A subtransmission system should be capable of serving load after the loss of a supply source, in this case a VELCO transmission substation. An example of the kind of loss the system should be capable of withstanding is the VELCO East Fairfax substation – this resource could be lost from the area when sections of the 34.5 kV line between the VELCO East Fairfax substation and the CVPS Johnson substation are faulted. Smith pf at 6.

20. Other contingencies that would result in the loss of this substation supply source from the LCSA include failure of the substation transformer, failure of other substation equipment, a bus fault, or loss of the VELCO 115 kV line from Georgia to East Fairfax. Depending on the characteristics of the specific failure, up to several days can be required for repair. Smith pf at 6.

21. Bus faults are a potential problem that a subtransmission system must be able to effectively cope with. At substations, the 34.5 kV buses provide the junction points between the large

115 kV to 34.5 kV transformers and the out-going 34.5 kV lines. Faults on a bus can have a severe impact because the sources of supply to an area become disconnected while the loads connected to the subtransmission lines remain intact. This scenario tends to pull down the voltages in the area and can overload the remaining lines feeding the area. Bus faults can be caused by insulator and other equipment failures and are permanent in nature. Outage times required for the repair can range up to 12 hours to a day or more depending on the failure. In addition, buses need to be taken out of service for scheduled maintenance. While such maintenance is usually scheduled for low-load periods, the network at this time is necessarily weakened and vulnerable to a much larger number of contingencies. Smith pf at 7.

Alternatives Considered

22. VELCO considered all reasonable T&D alternatives to the proposed project. Smith pf at 9-10.
23. VELCO analyzed more than 15 transmission alternatives. Among the most promising alternatives included: (1) adding capacitors to the system to the maximum extent feasible; (2) adding Flexible AC Transmission System (FACTS) devices to the system for dynamic voltage support; and (3) adding a second 34.5 kV subtransmission line from Duxbury to Stowe. Smith pf at 11.
24. With respect to the first alternative, installation of more capacitors on the local area system would not adequately address the problems identified because the capacitors can't be switched rapidly enough under contingency conditions to prevent voltage collapse. Smith pf at 11.
25. FACTS devices are capable of providing high-speed, continuously variable injection of reactive power following contingencies. This would maintain post-contingency voltage. Smith pf at 12.
26. Unfortunately, the cost of FACTS devices plus the cost of reconductoring results in this option being more costly than the proposed solution. Smith pf at 12.
27. Construction of a 34.5kV subtransmission upgrade does not adequately address the problems identified, because it would maintain reliability to a lower load level than that

achieved by the 115 kV option. Smith pf at 13.

28. The petitioners have proposed the appropriate transmission solution for the identified needs for the following reasons: (1) the proposed solution meets the needs, well into the future, for the "all lines in" condition; (2) the proposed solution provides reliable service, under first continency conditions, for load levels up to 98 MW; (3) the proposed solution is the least cost among the alternatives. Smith pf at 10-11.

29. These upgrades cannot be staged, or implemented in steps. In order to provide the desired reliability, all elements of the proposed solution are required to be in service simultaneously. Smith pf at 11.

30. The analysis and alternatives considered by VELCO in support of the project were appropriate and accurate. Allen pf at 6. Smith pf at 10.

31. VELCO studied scenarios in detail using industry standard analysis and the best comprehensive system model available. Smith pf at 10; Allen pf at 6.

32. From the standpoint of industry best practices, the proposed 115 kV transmission system upgrade solution meets the needs, well into the future, for "all-lines-in" service. Smith pf at 10-11.

33. The Petitioners' analysis of the potential for DSM to defer or avoid the proposed transmission upgrade proposed by the Petitioners in this docket is a rough calculation that is flawed in some respects. However, these flaws do not result in an erroneous conclusion. Given the need to acquire 34 MW immediately in order to negate the need for this project, there are insufficient cost-effective DSM resources available in the Lamoille County Study Area (LCSA) to avoid the proposed transmission upgrade. Welch pf. at 2.

34. The Petitioners' analysis of cost-effective DSM as an alternative to the proposed transmission upgrade is an estimate of the available energy efficiency potential in the entire Lamoille Loop Study Area. The analysis does not include an assessment of load management, load response, or other non-efficiency DSM options as tools to lower peak demand. The Petitioners limited consideration of load management and load control strategies to an assumption in its load forecast that whatever load management and load response was being acquired would continue to be acquired at the same rate. *Id*.

35. For acceptable reliability, the acceptable load for the existing LCSA system is 40 MW.

While the Petitioners' analysis is flawed in certain respects, current load for the LCSA is nearly 74 MW and growing. To keep the load below 40 MW, some load would have to be removed for up to 6,000 hours a year and during peak, 34 MW of load would have to be curtailed or removed immediately to avoid this project. It is clear that aggressive DSM resource acquisition is unlikely to result in the immediate acquisition of 34 MW of winter coincident peak load savings. *Id.* at 2, 6.

Forecast

36. VELCO provided a forecast of coincident peak load for the LCSA that shows growth from a current peak of roughly 74 MW (in the winter of 2004/05), to one that is about 19 MW higher in the next 10 years (in the winter of 2014/15). Allen pf at 12.
37. While the Department has some concerns with the forecast methods and believes that there are opportunities for controlling the load growth, it nonetheless has concluded that a transmission solution is needed even at existing loads, and that the forecasted loads are not unreasonable. Allen pf at 15-16.
38. The LCSA region is experiencing significant growth at this time and warrants immediate attention. Allen pf at 5.
39. The forecasts presented are not unreasonable when informed by recent patterns of growth, current plans for development in the Stowe community and the LCSA region, and generally the longer term patterns of development in Stowe and Vermont generally. Allen pf at 5.
40. The Petitioners forecasted a peak demand for the LCSA this last winter (2004/05) of 74 MW. Moulton pf at 5.
41. This matches the actual coincident peak load for the winter period, which was recently reported to be 74 MW on December 20, 2004. This new peak represented a significant increase from the last reported peak in 2003 of roughly 68 MW. Allen pf at 12-13.
42. While the forecast of load informs the planning analysis performed by VELCO, the planning analysis and the forecast of load in the LCSA ignore some important features of the existing system and customer opportunities that are embedded neither in the forecast, nor in the planning analysis. Allen pf at 13.
43. The Department is persuaded that the need for the project exists, that the load forecasts

used are not unreasonable, and that there is no cause for delay at this time. Allen pf at 13.

44. There are some offsetting factors, such as local generation that is available to ensure that desired voltages are maintained. Allen pf at 13.

45. There is more than 12 MW of available generation within the LCSA. The resources identified are hydro resources that typically operate at higher loads in the winter period when peak is likely to occur. Some of the units that are available even include a ponding capability. These units contributed over 4 MW toward the load during the most recent peak. Nevertheless VELCO has made the unduly conservative assumption that no local generation exists in its planning studies. Allen pf at 13.

46. However, even with further adjustments to the analysis by VELCO, the need is still pressing and is supported by the forecasts and the planning analysis. Allen pf at p.13.

47. The forecast in question here is of the coincident peak load for the LCSA. Allen pf at 12-13.

48. The forecasts of the individual utilities reflect the forecast of peak demand for the individual utilities, but do not reflect the forecast for the areas's coincident peak. The forecasted load "is the assumed coincidental winter peak load for the area." (Exhibit KSM4 - at 2). Nevertheless, the forecast presented was very close to the actual for the most recent winter period. Allen pf at 14.

49. Overall, the petitioners are forecasting peak load growth of about 2.3% on a compound annual basis over the next 10 years. For the current winter 2004/05, the coincident peak was approximately 74 MW. In 2015, they project a peak of 92.6 MW. Allen pf at 14.

50. Most of the growth in the forecast is in just two service territories, the Village of Stowe, and Green Mountain Power. Indeed, the majority (roughly 2/3rds) of the growth in the system is projected to occur in Stowe's 34.5 kV mountain line and the three distribution circuits in GMP's territory serving Waterbury and Waterbury Center. Allen pf at 14.

51. The LCSA system is already confronting major reliability concerns associated with existing loads and that those reliability concerns are severely heightened by even modest load growth. Allen pf at 15.

52. At a coincident peak of approximately 74 MW inside the LCSA, the system is incapable of supporting adequate voltage. This level was reached recently, however, local generation

was providing some of the local voltage support so voltage levels should have been maintained at target levels. Allen pf at 15.

53. At 2008 forecasted levels, loss of VELCO's Berlin 115/34.5 kV transformer would expose the system to voltage collapse. Moulton pf. at 5.

54. There is data which seems to show a sudden and quite significant rise in the coincident system peak from roughly 68 MW in the winter of 2002/03 to a peak of 74 MW in December of 2004. Exhibit KSM-2; Allen pf at 15.

55. This sudden change in the peak is troubling. Both size and the timing of the growth is a concern. Allen pf at 15.

56. The three years preceding the recent peak, the peak LCSA load was fairly steady at just below 68 MW. KSM-2 at 7, table 3. Allen pf at 15.

57. Peak growth appears to be suddenly increasing. This is an unexpected change since Stowe Mountain's load is constrained by existing contracts. Allen pf at 15.

Discussion

The Board is required to find that the proposal will meet the need for present and future demand for service which could not otherwise be met through a more cost effective method. 30 V.S.A. §248(b)(2). While the Department has some misgivings with the forecast methods, recent events support the forecasts of load presented in Exhibit KSM-2 that provides the foundation for the forecast of load, at least over the shorter run. Over time, the Department believes that the utilities should improve their forecast methods. The Department also believes there are some promising new avenues for actually managing the load growth, particularly in relation to larger customers with ability to shift load and rely on distributed generation. At this time, however, the Department concludes that the need for the project already exists even at current and historic load levels, and that the forecast of loads presented provides adequate justification for the project. The Department therefore recommends that the forecast presented by the Petitioners be used as the foundation for identifying the appropriate transmission solution, and that the Board find that Petitioners have met §248(b)(2) criterion.

§248(b)(3)

Proposed Findings

58. The appropriate reliability criteria for the LCSA is to maintain reliable service to all customers supplied by the area subtransmission system for the loss of any single transmission line section or for the loss of a primary supply source to the area. This is sometimes referred to as an "N-1" reliability criteria. Smith pf at 7.

59. The N-1 criteria is appropriate because subtransmission line faults are a relatively frequent occurrence and outage of any one of several sections of line can cause a collapse of the whole LCSA. Smith pf at 7.

60. In addition, faults on the VELCO system, including transformer, bus faults or 115 kV line faults, although less frequent, can also cause collapse of the LCSA and result in protracted outages. These outages can last for several hours or more, depending on the specific circumstances, creating hardship for a large number of customers. Smith pf at 7.

61. Furthermore, one of the primary justifications for investments in a looped system is the ability, after a contingency, to restore service to all loads, by switching, while repairs to the faulted section are underway. At present day load levels, the LCSA does not have this capability for over 40% of the hours in the winter, and 27% of the hours in a year. Smith pf at 7 .

62. The project as proposed will provide reliable N-1 performance for all likely contingencies up to a load level of 98 MW. Smith pf at 11.

63. The N-1 criteria is appropriate given the likelihood of occurrence of these contingencies, together with the relatively large load served by the LCSA. Smith pf at 7.

64. It is appropriate to have an N-1 criteria for the LCSA but not for those loads supplied by radial subtransmission. Smith pf at 8.

65. First, in the radial configuration, the number of customers served by the radial are typically much fewer than those served by a looped system such as the LCSA. Smith pf at 8.

66. Second, the radial lines are relatively short compared with the aggregate length of all portions of the loop that can cause trouble, therefore the exposure to faults is substantially less. Should a problem occur, the time to locate the problem will be less, resulting in a shorter outage time. Smith pf at 8.

67. Third, restoration of service to a radial feed, once the problem is repaired, is very simple -

close the circuit breaker and the lights come back on. For a looped network, restoration is more complex, involving switching circuits back into service in a sequence and energizing capacitor banks in a sequence, depending on the problem, the location, and the load level to be picked up (which is not precisely known) at the time of the restoration. In the case of the LCSA, the restoration process requires careful coordination among all of the utility operators involved. Smith pf at 8.

68. Due to adding a relatively low impedance transmission path from VELCO's K24 line to the center of the LCSA subtransmission system, there will be a slight increase in momentary voltage dips on the bulk system due to faults on the subtransmission network. Smith pf at 25.

69. This impact will be mitigated by the impedance of the 115 kV to 34.5 kV transformer at Stowe and by the addition of modern high speed fault clearing relays and breakers at the proposed Stowe site. Smith pf at 25.

70. The added 115 kV tap from Duxbury north to Stowe provides increased exposure to faults on this section of line. This slightly increases the frequency of momentary voltage dips on the bulk system. Smith pf at 25.

71. Outages of the K24 path to Essex, due to permanent faults on the 115 kV extension north from Duxbury, will only last for seconds due to the addition of high speed automatic sectionalizing equipment to be added at the Duxbury switching station. Smith pf at 25.

72. On the other hand, addition of the 115 kV breaker at Middlesex expedites the determination of fault location on the line section between Barre and Essex thereby enabling more prompt repair and restoration of this important transmission path. Smith pf at 25.

73. Overall, the reliability improvement afforded by the K24 breaker addition outweighs the slight increase in the addition of momentary voltage dips. Smith pf at 26.

74. The addition of the proposed 115 kV source near the electrical center of the LCSA substantially strengthens the network. The result is that momentary voltage dips are substantially reduced in magnitude. As described above, the addition of modern relays and breakers at the proposed new substation will decrease the duration of these voltage dips. Smith pf at 26.

Discussion

The Board is required to find that the proposal will not adversely affect system stability and reliability. 30 V.S.A. §248(b)(3). The proposal is being presented to the Board to address pre-existing and potential future reliability concerns. The proposal will enhance system stability and reliability and there will be no adverse impact on the same from the project. The Department therefore recommends that the Board find that Petitioners have met §248(b)(3) criterion.

§248(b)(4)

Proposed Findings

75. The project reduces peak losses by 4.1 MW based on a 77 MW load that is projected to occur within the next two years. Smith pf at 28.
76. For rate impacts, the proposed project will result in an increase in rates to Stowe of approximately 13%. Foley reb. pf. at 2. Tr. 07/18/05 at 7 (Allen).
77. A portion of the cost will likely be borne solely by Stowe Mountain Resort. Other customers will experience less significant impacts. Allen pf at 6. Tr. 07/18/05 at 7 (Allen).

78. One way the reliability of electric power can be valued is by examining the consequences and cost of an electrical outage. Unless an outage is truly short term, the consequences are not trivial: the contents of refrigerators may defrost and spoil; most business shut down; industrial companies could lose entire production lines or hours of lost output; and hourly workers may lose substantial wages. Unreliable electric power and/or electrical outages in the LCSA will cause significant economic loss, and limit any growth and development potential for existing customers and for any potential new customers. Foley pf at 7.
79. A reliable bulk power system enhances efforts to promote economic development and create jobs in Vermont. Foley pf at 7.
80. Job growth and economic revenue would be constrained without the project. Foley pf at 7.
81. The proposal will result in an economic benefit to the state. Foley pf at 8; Allen pf at 10.
82. Reduced property values could adversely affect property tax collections in certain areas and thereby lead to adverse economic impacts if tax rates were increased to compensate for the loss in property values. Foley pf at 5.

83. It is conceivable that the LCP could result in somewhat lower market values for some properties, especially those that are currently near distribution/transmission facilities, and those that would be near such facilities if the LCP were constructed. Foley pf at 5.

84. Any evaluation of the effects on property values and property tax collections must be compared against alternatives, and any potential increase in property value that might not occur without the project. Foley pf at 6.

85. Any decrease in property values is likely to be offset with increases in the property values of VELCO and the other electric companies, and in the overall increase in property values in the region due to general economic conditions in the region, which in large measure are driven and supported by the utility infrastructure. Foley pf at 6-7.

86. For instance, one such offset could be the proposed expansion at Stowe Mountain Resort, which would provide an estimated annual additional property tax revenues of $162,277. Foley pf at 7.

87. The LCP is not likely to result in adverse economic impacts associated with reduced property values and lower tax collections. Foley pf at 7.

Discussion

The Board is required to find that the proposal will result in an economic benefit to the state and its residents. 30 V.S.A. §248(b)(4). An important economic benefit of the LCSA is the needed stability and reliability for the Vermont transmission system that the LCSA will provide. Another important economic benefit is that the LCSA represents the least cost alternative to timely provide the required level of reliability.

The economic benefits of the LCSA to Vermont and its residents flows from the numerous advantages of a robust transmission system. A reliable source of electricity to meet demand provides a stable basis for economic growth and encourages a healthy business climate in the state. In addition, the LCSA will provide economic benefits by reducing the economic harm that could result from power outages caused by an insufficient transmission system. Therefore, the LCSA provides economic benefits to the state and its residents as required by § 248(b)(4). Accordingly, the Department recommends that the Board find that Petitioners have met §248(b)(4) criterion.

§248(b)(5)

Aesthetics

Proposed Findings

Project Context

88. The proposed Project, with the modifications and conditions required in this Order, will not have an undue adverse impact on aesthetics or on the scenic or natural beauty of the area. This finding is supported by findings __ to __, below.

89. The Department's witness, Mr. Raphael, conducted a thorough analysis evaluating the aesthetic impacts of the LCP. Mr. Raphael's analysis assessed the project's visibility and potential for visual and aesthetic impacts, with a focus on viewsheds from major federal, state or local roads, and public investments, which includes relationships to nearby areas of public interest, high scenic value and/or official designation as a cultural, aesthetic or recreational facility or resource, as well as road crossings and locations that involve individual residences or residential areas. Exh. DPS-DR-1 at 1.

90. Mr. Raphael's analysis included, but was not limited to:

1) An assessment of viewsheds, land uses and development patterns (both current and historic) in the vicinity of the proposed project area;

2) topography and slope;

3) Existing vegetation and forest cover, natural resource qualities;

4) Overall landscape character, which factored in the qualities and conditions present as well as the proximity and relation to the project;

5) Historical and cultural resources and public investments such as state lands;

6) Visual conditions and views as experienced and as analyzed;

7) Documentation provided with regard to history, use, character and conditions of various areas affected, such as the State Forest; and

8) Some sense and understanding of public concerns as they have been voiced both informally and formally during field trips, interviews and through available documentation. *Id*. at 2.

91. The Lamoille County Project is located in a section of Lamoille County that includes some

extensive public land holdings, developing residential and commercial areas, and has traditionally been a locus of tourism visits and recreational activities. The proposed project is located within four towns, two of which are particularly rural, Moretown and Duxbury and two of which are developing with tourism, commercial, industrial and residential uses and their associated infrastructure. *Id*. at 4.

92. The region affected by the proposed LCP has a distinct physiography that is delineated by two prominent mountain ranges, the high ridge of the main spine of the Green Mountains culminating in the state's highest peak, Mt. Mansfield, and to the east the Worcester Mountain Range. There are a number of hillsides, ridgelines and heights of land that are also part of the project area, and in the heart of the project area is the Mt. Mansfield State Forest and the Waterbury Reservoir, an important recreational and natural resource environment with high quality aesthetic values. Key natural features which demarcate the project area, aside from the Reservoir itself, are Crosset Hill in Duxbury, at the base of which a new corridor is proposed, the Winooski River and valley, over which the transmission line crosses, Blush Hill and Gregg Hill in Waterbury, along which the corridor continues, and the slopes and summits of Woodward and Ricker Mountain, rising to well over 3000 feet, providing the western backdrop for the Waterbury Reservoir. *Id*.

93. Downtown Waterbury and the villages of Waterbury Center and Moscow are part of the area affected and potentially served by this project and its associated upgrades. The principal transmission corridor route through Waterbury and Stowe follows a right-of-way and transmission line established as long ago as 1948-49 (Exhibit Boyle/Portz-3, p.7) and residences have been built adjacent to and in the vicinity of the corridor since that time. The terminus of the proposed project will be at the proposed new site at the Wilkins substation at the southern end of Stowe's Lower village substation. *Id*.

94. This area and region are considered to be highly scenic. The Interstate corridor itself, while developed along the Winooski River corridor in this area, affords outstanding views of the surrounding valley and mountain landscapes and carries commuter, commercial and tourist traffic (with an AADT (Average Annual Daily Traffic) of 27,200 at the Waterbury Exit), as does Route 100 (with an AADT of 10,900 at Moscow Road). Route 100 serves as a gateway to many of the state's and this region's most visited recreational and tourism

destinations, including Ben & Jerry's headquarters, the state parks around the reservoir, the village of Stowe, Stowe Mountain Resort and the Smugglers Notch State Park and scenic highway. This highway also has been considered for possible designation as a Vermont Scenic Byway (Green Mountain Crossroads, an application for portions of Routes 100, 100B, 108 and 17, June, 1995). Route 100B in the project area, located in Middlesex and Moretown is under current consideration for such designation. *Id*. at 5.

95. The backdrop of hills, the highest and some of the highest summits in Vermont in the Green Mountains and Worcester Range, the presence of open lands and river/stream courses, coupled with historic villages, homes and settled landscapes all combine to make the entire project area an important aesthetic resource for residents, visitors and recreationists and thus highly sensitive to change and visual impact. *Id.*

96. Based on the review of this entire proposed upgrade within the landscape context, it can be concluded that a number of important aesthetic and environmental qualities will be affected by the proposed construction. The impacts will accrue from the additional visibility of the proposed new lines and structures, which will be higher and of a larger scale, the placement of the new corridor in Duxbury, the required clearing and loss of vegetative screening, the addition of a second line, and the proposed designs of crossings at Route 89 and the Winooski River as well as at the Waterbury Reservoir. The proximity to and visibility of the line to numerous neighborhoods and residences also creates a sensitive situation with regard to aesthetic impacts. *Id*. at 6.

97. Overall, the region is one which often contains long distant views with the classic Vermont pastoral qualities and mountain backdrops. As an area that is visited by tourists and relies on this economy, and as a region with a rich culture and historic settlement patterns, the potential exists for undue, adverse impacts from this project absent appropriate mitigation. *Id.* at 7.

98. A majority of the LCP 115kV project as proposed will have an adverse impact on aesthetics. The combination of an additional new structure, up to two times higher than current structures in the region, the proximity to residences, the crossing of the open lands and the Interstate, as well as the crossing of the Waterbury Reservoir, all represent adverse impacts. *Id*. at 12.

Sensitive Areas

99. In a number of locations along the proposed LCP route, the potential exists for an undue, adverse impact on aesthetics if the project is constructed as proposed by VELCO. It is difficult, in some instances, to assess VELCO's proposed mitigation recommendations insofar as they are A) non-specific; i.e. the mitigation measure "selective clearing and vegetative management" does not provide sufficient detail to ascertain the efficacy of this method, or B) incomplete; i.e. specific planting plans, numbers and sizes have not been provided so as to understand how the measure will address the impact satisfactorily. *Id.* at 13.

100. In the areas listed below, construction of the LCP as proposed by VELCO has the potential to result in undue, adverse aesthetic impacts. However, the Quechee standard will be satisfied for these areas if the mitigation measures required by this Order are implemented. Areas with the potential for undue adverse impacts are:

- Duxbury Tap to Mile 0.5
- Blush Hill - Mile 0.8 to Mile 2.0
- Blush Hill - Mile 2 to Mile 2.8
- Gregg Hill - Mile 4.0 to Mile 5.7
- Stowe - Mile 6.8 to Mile 7.7
- Moscow Road, Little River and Nichols Field - Mile 7.7 to Mile 8.2
- River Road to proposed Stowe Substation - Mile 8.2 to Mile 9.4
- New Stowe Substation

Exh. DPS-DR-1 at 13 through 30.

Duxbury Tap to Mile 0.5

102. This is a scenic area as identified in the Duxbury Town Plan (page 46) and is frequented by outdoor recreation enthusiasts. There is high visibility of this section as well from the Interstate (although speed and orientation limit this to some extent) and certainly from River Road as well as North Main Street/Route 2 in Waterbury. There are also the open meadows and historic agricultural uses and architecture associated with the historic Atherton Harvey Farm. Exh. DPS-DR-1 at 14-15.

103. The changes associated with the proposed LCP will definitely result in an adverse impact, and have the potential to be undue because 1) local residents and visitors to the area may potentially be shocked or offended by the dramatic changes on Crosset Hill, in particular, and 2) while VELCO cites a corridor realignment as a mitigation measure, there are no specifics with regard to the extent of the visual impact, which will accrue from the required clearing. *Id*.

104. A number of alternatives are available that are variations on the single pole design proposed by VELCO. These alternatives include: 1) reducing the span length; 2) reducing the pole height above the topmost conductor attachment; 3) compressing the vertical distance between the conductors; 4) increasing the pole height; and 5) using Corten steel poles where pole color is important. Options 1), 2) and 3) reduce pole height while option 4) raises the height of the conductors so as to reduce the need to remove trees that provide visual screening or otherwise improve the appearance. Option 5) provides for a long term consistency of color where it is important to blend with the surrounding view. Smith pf. at 18-20; *see also* Smith sur. pf. at 6-8.

105. To avoid undue, adverse aesthetic impacts all of the following steps are necessary:

a. Employment of the single pole configuration options as proposed in DPS witness Smith's testimony, to limit height and visibility of the line and its structures as it crosses the open areas and the highways to Blush Hill. Poles need to be set back as far as feasible from road crossings to minimize their visibility head on to drivers or within their distinct cone of vision;

b. Detailed plans for clearing and retention of existing screen vegetation; and,

c. Detailed plans for developing effective "vegetative plugs" and street tree plantings and screen plantings along River Road, North Main Street and even along the Interstate, particularly as the corridor ascends Blush Hill. Unusual steps may be need to retain existing vegetation in this location in particular.

Exh. DPS-DR-1 at 15.

106. VELCO's aesthetics witnesses agree with the Department's planting recommendations for mitigation of adverse impacts in this area. Boyle-Portz reb. pf. at 3.

Blush Hill - Mile 0.8 to Mile 2.0

107. In this section where there is extensive residential development in proximity to the corridor, there is no question that the characteristics of the proposed upgrade represent an adverse impact. An adverse, undue impact is possible without more extensive plans for mitigation, which are reasonable and available. Exh. DPS-DR-1 at 16-17.

108. This area is sensitive aesthetically due to its residential population and proximity to the corridor, although the presence of the radio towers and the development pattern itself undermines some of the aesthetic values in this stretch. Views across the valley to the west are also an issue and further study is required to conclude definitively that the widened corridor and large poles do not create the appearance of a swath from a distance, when looking east to west. The line is close to several residences in a number of locations and in this area the increase in the corridor width and structure height of the single 115kV structure will potentially be shocking and offensive to the average person when viewing a before and after picture of both the new tower and resultant clearing. The increased height of 20' to 25' minimum over the existing poles is also a contributing factor. The lines and poles at the road crossings at Blush Hill and within several of the developments are currently readily visible. *Id*.

109. Undue, adverse impacts can be avoided if all of the following steps are taken:

a. Poles need to be set back from road crossings and properly screened with sufficient numbers of native plant associations;

b. Careful pole placement to avoid conflict and structure visibility close in to residences. Minimal clearing and vegetative retention details must be provided to provide the assurance that the available mitigation measures have been utilized to their fullest extent possible;

c. Pole heights and distances must be revisited in the context of local visibility so as to remove them from the view of the traveling public and/or residences, which will be impacted; and,

d. Selected street tree plantings are required in the vicinity of corridor miles 1.2 to 1.4 to minimize views from Blush Hill Road.

Id. at 16-17.

110. VELCO's aesthetics witnesses agree with the Department's recommendations for mitigation of adverse impacts in this area. Boyle-Portz reb. pf. at 3.

Blush Hill - Mile 2 to Mile 2.8

111. The route in this area parallels Blush Hill Road, where outstanding views to the east and the Worcester Range are accessible. It is a highly scenic area and needs special attention to protect the views. The area is also open and therefore affords less backgrounding and buffering with other vegetation and built elements. There are several historic properties whose view, like most of the other residences along Blush Hill, is to the east and therefore the proposed upgrade is present almost in the foreground of those views. This is a highly sensitive aesthetic area due to the accessible views from the road and residences and because of that fact, this area is visible from areas on the east side of Waterbury. An undue adverse impact on aesthetics is possible from this project as proposed. Exh. DPS-DR-1 at 17.

112. To avoid an undue, adverse determination all of the following steps are necessary to satisfy the Quechee standard:

a. The line needs to be rerouted as proposed by DPS witness Raphael, starting at mile 2.0/2.1 but further to the east than proposed by VELCO consultants, behind an intervening treeline at mile 2.2 and continuing north easterly to the east of the Blush Hill Estates and then angling northwesterly to where it rejoins the current corridor at mile 2.8. (See Exhibit DPS-DR-6 Proposed Aerial Reroute Map, which shows the proposed route). This routing will take the route below the line of sight and reduce their visibility and consequent impact in the landscape (See Exhibit DPS-DR-5 Line of Sight Section); and,

b. The lowest single pole structures need to be used, as the H-frame structures are more visible across the landscape and the single poles create a more uniform appearance, with less mass or elements visible in the landscape.

Id. at 17-18; *see also* Smith pf. at 18-20, Smith sur. pf. at 6-8 (regarding pole heights).

Gregg Hill - Mile 4.0 to Mile 5.7

113. At the point at which the transmission corridor emerges from the State Forest, it crosses and then parallels Gregg Hill Road, then proceeds northerly and traverses near a cluster of homes (mile 4.1 to 4.3) as it crosses again. This area is scenic and has a rural feel of woodlands and open pastures, treelines and hedgerows, which will be adversely impacted by the presence of the two lines and with new poles at a minimum approximately 10 to 20 feet higher than at present, with increased clearing. Retention of existing vegetation to the extent possible is an important factor in mitigating aesthetic impacts in this area. There are reasonable and available mitigation measures, which have not been presented by VELCO but which can avoid an undue adverse impact. Exh. DPS-DR-1 at 24.

114. Undue, adverse aesthetic impacts can be avoided if all of the following steps are taken:

a. Employment of the single pole configuration options as proposed in DPS witness George Smith's testimony, to limit height and visibility of the line and its structures as it crosses the open and settled areas, either in front of or behind the homes;

b. Poles need to be set back as far as feasible from the Gregg Hill Road crossing at mile 5.7 to minimize their visibility and vegetative plugs employed here as well; and,

c. A detailed plan for screen planting and buffering for all impacted residences, along with careful delineation of existing screen and buffer vegetation and how to protect/retain existing and important wooded areas and individual trees.

Id. at 24-25.

115. Except for the use of single poles at Miles 5.3 to 5.6, VELCO's aesthetics witnesses agree with the Department's recommendations for mitigation of adverse impacts in this area. Boyle-Portz reb. pf. at 13-14.

116. VELCO proposes the use of separate structures for the 115 kV and 34.5 kV lines north of the Blush Hill tap. However, a configuration comprised of single poles supporting both circuits would be feasible. Use of a single-pole, double-circuit design, with modifications to reduce pole height, will provide an appropriate level of reliability for the LCP while reducing aesthetic impacts. Smith pf. at 16-20; Smith sur. pf. at 6-8.

Stowe - Mile 6.8 to Mile 7.7

117. The corridor in this section comes exceedingly close to residences and access roads in the Black Bear Run Development and in the vicinity of Marshall Road. Through this area the line and corridor are immediately next to or in very close proximity to a number of residences and neighborhood roads. Mature vegetation currently screens or buffers those residences. With the higher poles in this area (as high as 65', 70' and 79') and the two lines being proposed, and insufficient mitigation measures being offered by VELCO, the project will have the potential for an undue adverse impact along this stretch of the route (See visual simulations of existing conditions and VELCO's proposed line placement in Exhibits DPS-DR-15 and DPS-DR-16). Exh. DPS-DR-1 at 25.

118. The characteristics of the proposed upgrade represent an adverse impact, a change that increases the presence of the utility corridor, and the scale of that presence in the landscape, resulting in an adverse effect. The extensive removal of mature trees and the poles twice the height of the existing poles along with the second set of 34.5kV structures will offend those who experience a before and after view of the change. Thus, an adverse, undue impact is possible without more extensive plans for mitigation, which are reasonable and available. *Id*. at 26.

119. To avoid an undue adverse impact, all of the following mitigation measures must be implemented:

    a. Employment of the single pole configuration options as proposed in DPS witness Smith's testimony, to limit height and visibility of the line and its structures as it crosses the open and settled areas, either in front of or behind the homes;

    b. Poles need to be set back from road crossings and properly screened with sufficient numbers of native plant associations. This will be particularly important at the Black Bear Run pond site, where street tree plantings will also be desirable to de-emphasize the line's presence. VELCO's consultant has recommended pole relocation in this area and that is one appropriate step;

    c. Careful pole placement to avoid conflict and structure visibility close to residences. Minimal clearing and vegetative retention details must be provided to assure that the available mitigation measures have been utilized to their fullest extent reasonably possible;

d. Pole heights and distances must be revisited in the context of local visibility so as to remove from the view of the traveling public and/or residences which will be impacted;

e. Roadside trees or street tree plantings along Route 100 as it parallels the line at mile 7.5 to mile 7.7 will be necessary to screen or buffer the route from the traveling public along Route 100;

f. Details of mitigation plantings at the residences; and,

g. Detailed plans for existing vegetation showing what will be retained, as well as proposed new plantings to buffer and screen the line and poles in the open area.

Id.

120. Based on aesthetic considerations alone, VELCO's aesthetics witnesses agree with the Department's recommendations for mitigation of adverse impacts in this area. Boyle-Portz reb. pf. at 14.

121. VELCO proposes the use of separate structures for the 115 kV and 34.5 kV lines north of the Blush Hill tap. However, a configuration comprised of single poles supporting both circuits would be feasible. Use of a single-pole, double-circuit design, with modifications to reduce pole height, will provide an appropriate level of reliability for the LCP while reducing aesthetic impacts. Smith pf. at 16-20; Smith sur. pf. at 6-8.

Moscow Road, Little River and Nichols Field - Mile 7.7 to Mile 8.2

122. This is a highly visible and well-traveled area that has been highlighted as aesthetically sensitive due to its location, the use of the Little River for fishing and swimming, and the presence of a public investment in the Nichols Field preserved lands. The traffic on Route 100 and Moscow Road will have specific views of this area. The Little River itself is picturesque and represents an important natural feature in this area. The removal of the Moscow substation offers some improvement to aesthetics in the area, but the addition of the new line, conductors, structures, and clearing required, increases the scale and impact of the transmission corridor and its associated elements. In an open visible landscape the clutter of the poles all jumbled in the viewshed from the roads will be particularly disturbing and offend Stowe residents and visitors to the area. Thus, without sufficient and

reasonable mitigation, and because it will offend or shock the citizens of Stowe if built, the potential exists here for an undue, adverse impact on aesthetics. Exh. DPS-DR-1 at 27.

123. In order to avoid an undue adverse impact, all of the following mitigation measures must be implemented:

a. Employment of the single pole configuration options as proposed in DPS witness Smith's testimony, to limit height and visibility of the line and its structures as it crosses Moscow Road and proceeds to mile 8.2 beyond River Road;

b. Roadside and street tree plantings widely spaced along Moscow Road and Route 100 to buffer views of the corridor; and,

c. A detailed planting plan for extensive floodplain plantings, and buffer plantings along River Road and to "plug" the corridor as it ascends the hill above River Road. The floodplain plantings should follow the river course and help address streambank restoration efforts as well.

Id. at 27-28.

124. Except for the proposal to use a single-pole configuration, VELCO's aesthetics witnesses agree with the Department's recommendations for mitigation of adverse impacts in this area. Boyle-Portz reb. pf. at 15.

125. VELCO proposes the use of separate structures for the 115 kV and 34.5 kV lines north of the Blush Hill tap. However, a configuration comprised of single poles supporting both circuits would be feasible. Use of a single-pole, double-circuit design, with modifications to reduce pole height, will provide an appropriate level of reliability for the LCP while reducing aesthetic impacts. Smith pf. at 16-20; Smith sur. pf. at 6-8.

River Road to proposed Stowe Substation - Mile 8.2 to Mile 9.4

126. Most of the route in this area is located away from residences and is less visible than the previous sections until mile 9.15, where it emerges from a wooded corridor and travels through open land and near residences located on or along Cady Hill Road. Construction of the line as proposed in this area will be adverse and risks becoming unduly adverse without appropriate and reasonable mitigation measures. The new lines and the heights of the poles as tall as 65 to 79 feet will shock the average person due to the substantial change

in size and scale from what is there presently. This stretch is slated for both a 115kV line and two co-located 34.5kV lines. Exh. DPS-DR-1 at 28.

127. An undue, adverse impact in this area can be avoided if all of the following mitigation measures are implemented:

a. Employment of the lowest height pole configuration options, for each line, to limit visibility of the line and its structures as it crosses the open and settled areas in the vicinity of Cady Hill Road, and to reduce clearing widths; and,

b. Detailed plans for existing vegetation showing what will be retained, as well as proposed new plantings to buffer and screen the line and poles in the open area; and,

c. Details of mitigation plantings at the residences themselves.

Id.

128. VELCO's aesthetics witnesses agree with the Department's recommendations for mitigation of adverse impacts in this area. Boyle-Portz pf. reb. at 16.

129. VELCO proposes the use of separate structures for the 115 kV and 34.5 kV lines north of the Blush Hill tap. However, a configuration comprised of single poles supporting both circuits would be feasible. Use of a single-pole, double-circuit design, with modifications to reduce pole height, will provide an appropriate level of reliability for the LCP while reducing aesthetic impacts. Smith pf. at 16-20; Smith sur. pf. at 6-8.

New Stowe Substation

130. At mile 9.4 the proposed new Stowe Substation will be located in a residential area near the Stowe Lower Village Historic District, and within view of that district. The proposed new substation, at 190' by 230' will have a one-acre footprint in addition to the present substation. While there is a small existing substation on the site today, the existing vegetation and scale are appropriate to the site topography and screening vegetation. Limited views from Cady Hill Road and surrounding residences are and will be possible with the new substation constructed. Exh. DPS-DR-1 at 29.

131. The substation structures will be visible from the Lower Village Historic District. This is a scenic and historic area that will be adversely impacted by the new substation, which will

be a minimum of 75 feet above the village and over 100 feet above the Little River. The Lower Village is some 1000 feet distant and thus is proximate enough to experience an adverse impact from this proposed substation, which is not consistent with its surroundings. *Id*.

132. The substation will have one light on a photocell, which will not pose a problem due to the distance of abutting neighbors in the immediate vicinity, and with proposed new screening and planting. The perimeter lights will be used only for emergency purposes. *Id*.

133. The noise generated by this facility will have a minimum impact on the Village area, but there are several residences a few hundred feet from the proposed new sub and a total of 12 existing surrounding homes, as well as 15 proposed new homes that will be receptors of the noise increase. The existing residences will experience an increase in noise of up to 35 to 39dBA, which, although below World Health Organization standards as cited in VELCO Exhibit KHK-3, will still potentially result in an adverse impact. *Id*. at 29-30; Smith pf. at 27-28.

134. The proposed new substation will result in an adverse impact. The current mitigation plans are not sufficient to fully reduce the visual and aesthetic impacts of this proposed substation. In the absence of additional mitigation, an undue adverse impact could result. In order to avoid an undue adverse impact, all of the following steps must be taken:

a. Redesign and expansion of the berming and planting to reflect natural patterns and extension of existing topography;

b. Additional native plantings with a range and diversity of native species to create a natural vegetative pattern on 3 sides of the project area (north, south, and east); and,

c. A reliable existing vegetation map needs to be prepared and all existing vegetation outside of the expansion footprint delineated and, where important or part of a screening plan, protected.

d. VELCO must make post-construction noise measurements at the existing and planned home sites to ensure that the "as constructed" operating noise is equal to or lower than the estimated levels arrived at through computer modeling. Further, the Board will retain jurisdiction to require VELCO to take all reasonable steps to

address noise concerns identified by the public, as a result of the project.

e. Additionally, and as an effective alternative mitigation measure that will aid in screening and buffering, the proposed new footprint should be separated from the Wilkins sub and shifted slightly to the south to allow the existing row of deciduous vegetation just south of the Wilkins sub to be retained.

Exh. DPS-DR-1 at 30; Smith pf. at 28.

Discussion

When evaluating the aesthetic impacts of projects reviewed under §248, the Public Service Board employs the "Quechee analysis" formulated by the Vermont Environmental Board. Docket 6860, Order of 1/28/05 at 79. The Quechee analysis first requires an assessment of whether the proposed project, if constructed, will have adverse impacts on aesthetics and scenic or natural beauty, using specific factors to guide the evaluation. If there are adverse impacts, the Board must consider whether such impacts are "undue." The following factors inform this inquiry:

1. Does the project violate a clear, written community standard intended to preserve the aesthetics or scenic beauty of the area?

2. Have the applicants failed to take generally available mitigating steps which a reasonable person would take to improve the harmony of the project with its surroundings?

3. Does the project offend the sensibilities of the average person? Is it offensive or shocking because it is out of character with its surroundings or significantly diminishes the scenic qualities of the area?

Finally, before reaching a conclusion as to whether any adverse impacts are undue, the Public Service Board considers the "overall societal benefits of the project." Docket 6860, Order of 1/28/05 at 79-80 (footnote omitted).

The Department of Public Service retained a highly qualified and experienced expert, David Raphael, to review the aesthetic impacts of the LCP and recommend appropriate mitigation measures where necessary. Raphael pf. at 1-2. Mr. Raphael's work was augmented by the engineering expertise of DPS witness George Smith, who evaluated the feasibility of alternative line designs (such as arranging two circuits on a single pole line, rather than VELCO's proposed double pole line).

The PSB should conclude that the Lamoille County Project will not have undue adverse aesthetic impacts, if those impacts are mitigated in accordance with the Department's recommendations presented in this Brief.

Waterbury Reservoir

135. At the Waterbury Reservoir crossing, VELCO proposes to rebuild the existing 34.5 kV lines with taller structures, add new structures to carry the 115 kV lines, and widen the cleared area on both sides to accommodate the new and larger structures. Exh. DPS-DR-1 at 21; Exh. VELCO-Boyle/Portz 3 at 39-40; Exh. VELCO-RCJ-22. In Mr. Raphael's opinion, burial of the transmission lines under the reservoir is the only available option to mitigate the adverse aesthetic impact of the crossing. Exh. DPS-DR-1 at 23.

136. The cost of undergrounding both the 115 kV and 34.5 kV circuits at the Waterbury Reservoir to be in the range of $4.1 to $5.9 million. Smith pf. at 23.

137. The proposed undergrounding would impose an extraordinary cost in proportion to the project, and would impose an unreasonable burden on ratepayers. The roughly $4.1 to $5.9 million in additional costs would be borne disproportionately by a small group of ratepayers. Allen pf. at 7-8. Undergrounding at the reservoir would add over 20% to the cost of the LCP. Moulton reb. pf. at 4.

Discussion

Based on the foregoing findings, the Board should conclude that burial of the proposed (and existing) transmission lines under the Waterbury Reservoir is not required to satisfy the aesthetics criterion of § 248. The primary reason for such a conclusion is that burial is not a "generally available" mitigation option that a "reasonable person" would take, in light of the extraordinary cost of burial - especially in relation to the overall cost of the LCP. *Compare* In re Petition of Tom Halnon, CPG NM-25, Order of 3/15/01 at 15 (Board denied CPG for wind turbine where relocation of turbine was a potentially effective mitigating step "and the *relative costs* of that relocation . . . *have not been shown to be excessive* . . . .") (emphasis added).

Moreover, as the Board has often stated, its "assessment of whether a particular project will have an 'undue' adverse effect on aesthetics and scenic or natural beauty is 'significantly

informed by overall societal benefits of the project.'" In re Northwest Reliability Project, Docket 6860, Order of 1/28/05 at 80, *quoting* In re Northern Loop Project, Docket 6792, Order of 7/17/03 at 28. The societal benefits of the LCP are substantial, and essentially undisputed: it will provide reliable electric service to an area where loads already exceed the ability of existing transmission to reliably serve them, and where economic growth and development depend on reliable electric service. *See* Allen pf. at 5-6; Foley pf. at 4-8. However, these societal benefits come at the cost of non-trivial rate impacts (Foley pf. at 3-4); adding the significant cost of undergrounding would materially increase those rate impacts, and reduce the net societal benefits available from the LCP. The Board should also consider the fact that these costs would fall on a relatively small subset of Vermont ratepayers. Allen pf. at 8. The evidence shows that these "real costs" of burial would "significantly exceed the aesthetic benefits," a conclusion supported by the fact that no party in these proceedings is advocating burial. Docket 6860, Order of 1/28/05 at 140.

In light of all of the circumstances, the Board should conclude that burial of the LCP (with or without burial of the existing lines) under the Waterbury Reservoir is not a reasonable mitigation option, that the costs of burial are disproportionate in relation to this project, that it would be inequitable to impose those costs on a small group of ratepayers, and that therefore burial should not be required.

Gregg Hill Reroute Proposal

138. A group of residents (the "Gregg Hill Residents") living on Gregg Hill Road in Waterbury have proposed an alternative route (the "Gregg Hill reroute") for the portion of the LCP that traverses their neighborhood. This alternative route would depart from the existing ROW just north of the Waterbury Reservoir crossing, cross Gregg Hill Road and the height of land on State Forest land, and proceed northward generally along the eastern boundaries of properties owned by the Gregg Hill Residents. The Gregg Hill reroute would rejoin the existing ROW where the existing ROW crosses Gregg Hill Road approximately at the northwest corner of a parcel owned by Faith Bieler. Exh. GHR-1 at 1; Exh. Boyle/Portz Surrebuttal 1.

139. The Gregg Hill reroute does have some aesthetic advantages from Gregg Hill Road and from the residences located on Gregg Hill Road. However, it is more expensive, requires

clearing a new 100' ROW on 1400' of undeveloped State Forest land, and has engineering and environmental challenges. Boyle/Portz sur. pf. at 4-5; Frederick reb. pf. at 5.

140. The Gregg Hill reroute has offsetting aesthetic disadvantages, described in the surrebuttal testimony of DPS witness David Raphael and the testimony of witnesses for the Agency of Natural Resources. It is also inconsistent with state policy concerning the use of state lands, and adds cost to the project for the benefit of a few residents of Gregg Hill. Allen sur. pf. at 1-2; Raphael sur. pf. at 1.

141. While it would benefit only a few individuals and property owners, the Gregg Hill reroute would potentially impact thousands of individuals who visit the State Forest and Park. The reroute would require cutting a new corridor, in contravention of the principle of using existing utility corridors wherever feasible. Moreover, VELCO's proposal for construction in the existing ROW can be implemented without undue adverse impact, using mitigation measures described in Exh. DPS-DR-1. Raphael sur. pf. at 1-2.

142. The terrain in the area that would be crossed by the Gregg Hill reroute is very difficult in places, which may require extensive clearing and impact from the construction alone. The landscape, aesthetic and natural resource values would be irreparably degraded by the construction of a new corridor in this location. *Id.* at 2.

Public Health & Safety - Electromagnetic Fields (EMF)

Proposed Findings

143. Electric and magnetic fields produced by the proposed Project will not have an undue adverse effect on the public health or safety. This finding is supported by findings ___ through ___, below.

144. There are two general types of EMF, steady (or "direct current fields") and time varying (or "alternating currents fields"). It is time varying or alternating current fields that have been the source of the majority of the medical studies. EMF from transmission lines, distribution lines, and electric appliances is an alternating current field and has a frequency of 60 hertz ("Hz"). Valberg pf. at 4–5.

145. EMFs are produced by high voltage transmission lines, distribution lines, wiring in buildings, and many commonly used appliances. Magnetic power frequency fields close to

electrical appliances are often much stronger than those from other sources, including power lines. Exposures vary widely from clothes washers (up to 3 mG at 4 inches) to can openers (up to 4000 mG at 4 inches). Exh. DPS-VDH-3 at 8.

146. Exposure to magnetic fields can be reduced in a number of ways, most easily by increasing the distance from the power lines. Magnetic field levels decrease rapidly with even minor distance from a source. Other means exist, such as putting wires underground, or the measures noted in the finding above. Exh. DPS-VDH-3 at 11.

147. Currently, there are no federal standards for occupational and residential exposure to EMF, nor standards or guidelines limiting EMF fields for appliance manufacturers at this time. Established guidelines for exposure to magnetic power frequency fields range from 150 mG (Florida) to 9,040 mG (Institute of Electrical and Electronics Engineers). Guidelines for exposure to electric power frequency fields range from 2.0 kV/m (Florida) to 5.0 kV/m (IEEE and Germany). The Florida standards are based on current fields produced by power lines now in operation; they are not health-based standards. These fields are unlikely to be encountered in daily life. Typical magnetic power frequency fields in the home average 0.6 mG and range from 0.1 to 4 mG over a period of a day. Average electric power frequency fields in the home range from 0 to 0.01 kV/m. Exh. DPS-VDH-3 at 8.

148. The VDH performed calculations using an EXCEL format of the Bonneville Power Authority program provided by VELCO to derive existing and projected estimates of the electric and magnetic power frequency fields. Data was provided by VELCO and is listed in Appendix A. The calculations use the maximum power line kV, the maximum sag (minimum allowed height above the ground) and maximum line to ground voltage. The transmission line is modeled as a horizontal line at the estimated sag height. Exh. DPS-VDH-3 at 25.

149. The ROW of the Proposed Lamoille Project ranges from 100 feet to 175 feet. Calculations were performed using a conservative assumption of a 40-foot ROW based on the distance of existing homes from the proposed power line. Cross-sections for each corridor were taken from Ryan C. Johnson's Exhibits RCJ-18, RCJ-19, RCJ-20, RCJ-21, RCJ-22, and RCJ-23. Using these parameters and assumptions the estimated existing and projected results are maximum possible values for the electric and magnetic power frequency fields.

The results of these calculations are very conservative estimates and are not "real" or measured fields. *Id*. at 26.

150. Comparison of the electric and magnetic power frequency fields calculated by the Vermont Department of Health indicate different values than those reported in the Direct Testimony of Peter A. Valberg (12/6/2004) because data provided from VELCO for this report was based on the absolute maximum sag assuming NESC minimum clearance heights, average loading (50% of winter peak load), and maximum continuous loading of the power lines. As a result, the estimated electric and magnetic power frequency fields calculated using these parameters are more likely to represent the highest expected fields along each corridor, so that the VDH can assure that the highest expected fields will not exceed the ICNIRP guidelines. *Id*.

151. The magnetic power frequency fields at the edge of the ROW for average loading with the Lamoille Project are projected to be on the order of 6 times less than the Florida guideline of 150 mG and 30 times less than the ICNIRP guideline of 833 mG for public exposure. The electric power frequency fields at the edge of the ROW for average loading with the Lamoille Project Proposed Reroutes are projected to be less than the Florida guideline of 2 kV/m, and 3 times less than the ICNIRP guideline of 4.2 kV/m. This demonstrates that the projected magnetic and electric power frequency fields for average loading for the Lamoille Project Proposed Reroutes are well below the health-based ICNIRP guidelines. *Id*. at 28.

152. The magnetic power frequency fields with the Lamoille Project for average loading directly under the power lines are projected to be on the order of 4 times less than the Florida guideline of 150 mG and 25 times less than the ICNIRP guideline of 833 mG for public exposure. The electric power frequency fields directly under the power line for average loading with the Lamoille Project Proposed Reroutes are projected to be approximately 4 times less than the Florida guideline of 8 kV/m, and 2 times less than the ICNIRP guideline of 4.2 kV/m. This demonstrates that the projected magnetic and electric power frequency fields for average loading directly under the power line for the Lamoille Project are well below the health-based ICNIRP guidelines. *Id*. at 30.

153. The magnetic power frequency fields at the edge of the ROW with the Lamoille Project for

maximum continuous loading are projected to be approximately 3 times less than the ICNIRP guideline of 833 mG, and 25 times less than the IEEE guideline of 9,040 mG for public exposure. This demonstrates that the projected maximum magnetic power frequency fields at the edge of the ROW for the Lamoille Project are well below the health-based ICNIRP guideline. *Id*. at 31.

154. The magnetic power frequency fields with the Lamoille Project for maximum loading directly under the power lines are expected to be on the order of 2.5 times less than the ICNIRP guideline of 833 mG and 25 times less than the IEEE guideline of 9,040 mG for public exposure. This demonstrates that the projected maximum magnetic power frequency fields directly under the power lines for the Lamoille Project are well below the health-based ICNIRP guideline. *Id*. at 32.

155. Examination of the U.S. Food and Drug Administration MedWatch and MAUDE databases and the National Library of Medicine, as of March 2005, did not identify any safety alerts, advisories, notices or adverse events identifying power line frequency EMF as a cause of medical device malfunction. Exh. DPS-VDH-3 at 35.

156. The maximum electric and magnetic power frequency fields that could be produced by the Lamoille Project are expected to range from 0.72 to 2.54 kV/m, and 169 to 417 mG, respectively. These fields are based on calculations using the maximum continuous load rating, the maximum power line voltage, the minimum allowed height above the ground, and directly under the power line. The magnetic power frequency field, under these conditions, is projected to be approximately 2 to 4 times less than the ACGIH guideline of 1000 mG for occupational workers. The electric power frequency field, under these conditions, is projected to be higher than the ACGIH guideline of 1 kV/m. This type of condition is expected to occur very infrequently. *Id.*

157. Under conditions of normal power use, at average loading and at the edge of the right of way, the magnetic power frequency field will range from 13 to 44 mG and the electric power frequency field will range from 0.61 to 1.91 kV/m in 2015. It should be noted that the proposed height of the power lines is planned to be 5 feet higher or more than that assumed in this analysis. This increase in line height will reduce the electric power frequency field to levels below 1 kV/m. Valberg pf. at 21.

158. In summary, the projected electric and magnetic power frequency fields for the Lamoille Project at the edge and in the ROW are not likely to interfere with medical devices worn by the public. The projected electric and magnetic power frequency fields for the Lamoille Project are projected to be less than the ACGIH guidelines of 1 kV/m and 1000 mG at the edge of the ROW. *Id.* at 36.

Discussion

The Board should conclude, as it did in Docket 6860 with respect to the Northwest Reliability Project, that the electric and magnetic fields ("EMF") that will result from the Lamoille County Project are very unlikely to have an undue adverse impact on public health. Docket 6860, Order of 1/28/05 at 62 *et seq*; Exh. DPS-VDH-3 at 7. In Docket 6860 the Board concluded that:

> The sparse evidence that EMF may be linked to childhood leukemia is insufficient to outweigh the public benefits of the proposed Project. Instead, the Board will adopt the policy of prudent avoidance that the National Institute of Environmental Health Sciences and the Vermont Department of Health have endorsed. The substantial majority of the public health agencies that have analyzed this issue have concluded that the tenuous link between EMF and childhood leukemia is insufficient to require large-scale expenditures of funds to mitigate EMF levels from transmission projects such as the one before us.

Docket 6860, Order of 1/28/05 at 63. The same fundamental conclusion is appropriate in this docket.

The evidence in this proceeding demonstrates that public health and safety will not be adversely affected by construction and operation of the LCP. This conclusion applies to individuals wearing medical devices as well as to members of the general public.

§248(b)(6)

Proposed Findings

159. VELCO does not have an approved least cost integrated plan. Allen pf at 11.

160. GMP and Stowe have both offered testimony in support of the project in relation to their approved least cost plans. Allen pf at 11.

161. The principles of least cost planning have been applied to this project. Welch pf at 2; Allen pf at 11.

162. The project meets the principles of least cost planning. Allen pf at 11.

Discussion

The Board is required to find that the investments and construction are consistent with the principles for resource selection expressed in the company's approved least cost integrated plan. 30 V.S.A. §248(b)(6).

VELCO does not have an approved least cost integrated plan. To date, the Board has not required VELCO to have a least-cost integrated plan because VELCO is a non-distribution utility whose capital expenditures are already subject to Board review. Docket No. 5778, Order of March 12, 1996 at 22. The Board previously has ruled that to obtain a CPG under § 248, a company which does not have an approved least-cost integrated plan must demonstrate that the proposed project is consistent with the principles of least-cost integrated resource planning. In re Citizens Utilities Co. (Baldwin Hydro), Docket No. 5737, Order of April 17, 1995 at 16, 30.

Therefore, under this criterion, the standard to be applied to the LCSA is whether it is consistent with the principles of least-cost planning. The Department contends that the findings of fact proposed above support an affirmative conclusion under this standard. The Department therefore recommends that the Board find that Petitioners have met §248(b)(6) criterion.

§248(b)(7)

Proposed Findings

The Board is required to find that the proposal is in compliance with the electric energy plan approved by the department under section 202 Title 30. 30 V.S.A. §248(b)(7).

163. The project complies with the Department's electric energy plan. Tr. 07/18/05 at 10 (Allen); Exh. Cross Riley 1.

Discussion

Based on the finding proposed herein, the Department recommends that the Board find that Petitioners have met §248(b)(7) criterion.

§248(b)(8)

Proposed Findings

The Board is required to find the proposal does not involve a transmission facility that has an undue adverse effect on any outstanding resource waters. 30 V.S.A. §248(b)(8).

164. The proposal does not involve a transmission facility that has an undue adverse effect on any outstanding resource waters. Allen pf at 11.

Discussion

The Department recommends that the Board find that criterion §248(b)(8) does not apply to this petition.

Post-Certification Review

The technical hearings have confirmed the importance of evaluating the site-specific impacts of the LCP on aesthetics and natural resources. The Board should approve the LCP subject to post-certification review procedures that include engineering review of final design plans and review of those plans for aesthetic, natural resource, and other site-specific impacts. The Board has the authority to employ such a procedure rather than to require preparation of detailed and costly final plans for an entire project prior to issuance of a CPG. In re Vermont Elec. Power Co., Inc., 131 Vt. 427, 434-435 (1973); In re Petition of Twenty-Four Vermont Utilities, 159 Vt. 339 (1992).

Given the size and complexity of the LCP and the consequent expense of preparing and revising final plans, the potential impact to parties, and the need for timely meeting Vermont's reliability needs, the Board should not only use a post-certification review procedure, but also should, in crafting such a procedure, strive to strike a reasonable balance between the need for timely construction of the project to assure reliability and the need to allow for the participation of the affected towns and regions and property owners and assure the facilities are appropriately designed and mitigated to address project impacts.

This is no easy task. Below, the Department sets out a proposal for a post-certification procedure that attempts to strike that reasonable balance. However, the Department does not pretend that it, or any one party, necessarily has the correct answer to the question of how best to design a post-certification procedure for a project that, for Vermont, is of unique size and scope.

The steps suggested by DPS for post-certification review are as follows:

1. Filings by VELCO. VELCO should file final design plans for segments and components of the LCP on a series of dates keyed to VELCO's proposed construction schedule. These design plans at minimum should show proposed locations and design details for all facilities, proposed clearing, proposed noise mitigation, and proposed aesthetic mitigation. The filings should conform to the recommendations contained in the Board's order. To set the schedule for VELCO filings, the Board should require VELCO to file, within two weeks of issuing a CPG, VELCO's proposal for the dates on which it will make these filings. This schedule should be subject to party review and comment and Board approval, which must occur prior to commencement of construction on the given segment or component. See below for further schedule discussion.

2. Staking Final Design and Mitigation in the Field. At the time it files final design plans for a given segment or component of the LCP, VELCO should stake in the field its final design and proposed mitigation for all substations, road crossings, and other areas determined to be sensitive by the Board within that segment or component. In this regard, those sensitive areas should at a minimum include each area in which the Board concluded that an undue adverse impact would result in the absence of sufficient mitigation, as detailed in the findings of fact of the Board's order. For these locations, VELCO also should develop digital representations of the final layout to assist in the field review process. Once VELCO completes the staking, it should notify the Board, DPS, the affected town(s) and region(s), and any existing intervenors whose interests are directly affected by the facilities within the given segment or component. Examples of such directly affected intervenors would be those over whose property a transmission line would cross or those who own or reside on property from which the proposed facilities may be visible.

3. Time-frame for Review. Parties affected by a given segment should be given a time-frame for field inspections and review of and comment on final designs. This time-frame should be set via a status conference held by a hearing officer after each VELCO filing is made

according the schedule discussed earlier, so that the time-frame is informed by actual consideration of the filing. Alternatively, following submission of VELCO's proposal for when it will file the final design plans, a status conference could be held to discuss setting a default time table for review of each segment or component.

4. Negotiation of Design Changes with VELCO. Within the time-frame for review of final designs, parties affected by a given segment should attempt to negotiate design changes with VELCO. Any agreements would be filed with the Board for approval.

5. Facilitated or Mediated Dispute Resolution. Where direct negotiation does not resolve disputes, parties could be required to attend a session with a facilitator or mediator retained by the Board, with costs allocated to VELCO under 30 V.S.A. § 21, and to work in good faith with the facilitator or mediator to resolve their differences. The facilitator or mediator would issue a report of the session stating any agreements reached and remaining differences. Any agreements reached would be subject to Board approval. Since the facilitator would work directly with the parties, the facilitator would not participate in Board deliberations or directly advise the Board.

8. Dispute Resolution by Board. Where disputes are not resolved by direct or facilitated negotiation, parties affected by a given segment would be able to file comments with a Board hearing officer, who may hold a hearing upon a determination that substantial issues are raised requiring a hearing. The hearing officer would be appointed specifically for the purpose of rapidly resolving disputes arising in post-certification review. If necessary, the hearing officer would be retained from outside existing staff with costs allocated to VELCO under 30 V.S.A. § 21. The Board would set aside a specific day or days in its calendar, measured in a time frame from the date on which final design plans for a given segment are filed, for hearing any oral arguments and deciding any protests of hearing officer decisions.

9. Standard for Post-Certification Review. The Department proposes that the standard for post-certification review should be whether the final design plans are consistent with

the Board's approval and whether the proposed plans and mitigation function as anticipated. In this regard, the Board should clearly state, in its decisions, its expectations for the effectiveness of design and mitigation.

CONCLUSION

Based on the foregoing proposed findings and conclusions, the Public Service Board should find and conclude that construction of the Lamoille County Project, with modifications as recommended above, meets the criteria of 30 V.S.A. §248(b) and therefore promotes the general good of the State. The PSB should issue a Certificate of Public Good to Petitioners with appropriate conditions, and establish a procedure for post-certification review, all as set forth above.

Respectfully submitted this 10th day of August, 2005.

VERMONT DEPARTMENT OF PUBLIC SERVICE

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